SBX-80

SERVICE NOTES

First Edition

SPECIFICATIONS

INPUT

SMPTE LOAD

LEVEL	:	1.5Vp-p–1.0Vp-p	
TAPE TRANSFER SPEED	:	NTSC	2400 baud
		PAL/SECAM	2000 baud
FRAME FREQUENCY	:	NTSC	30 FRM/sec
		PAL/SECAM	25 FRM/sec

AUDIO IN

LEVEL	:	–20dBm
IMPEDANCE	:	33K

OUTPUT

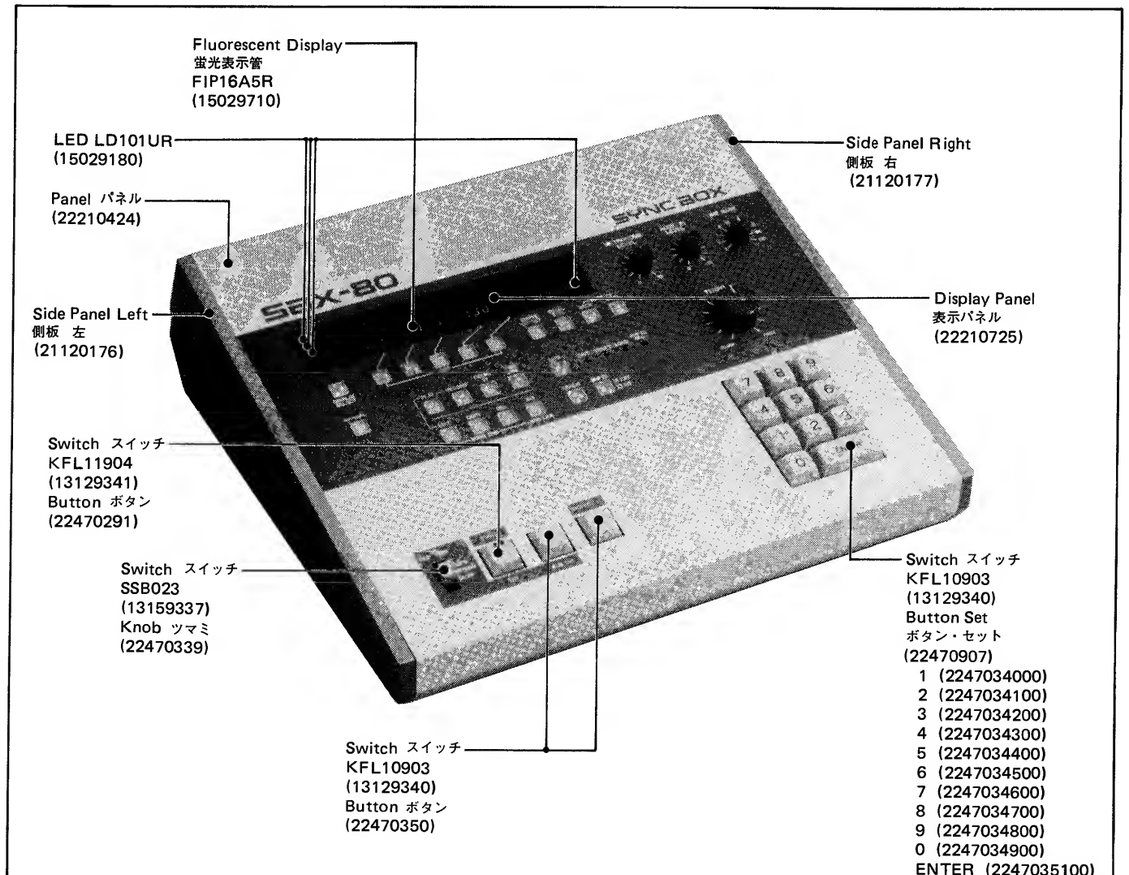
SMPTE SAVE

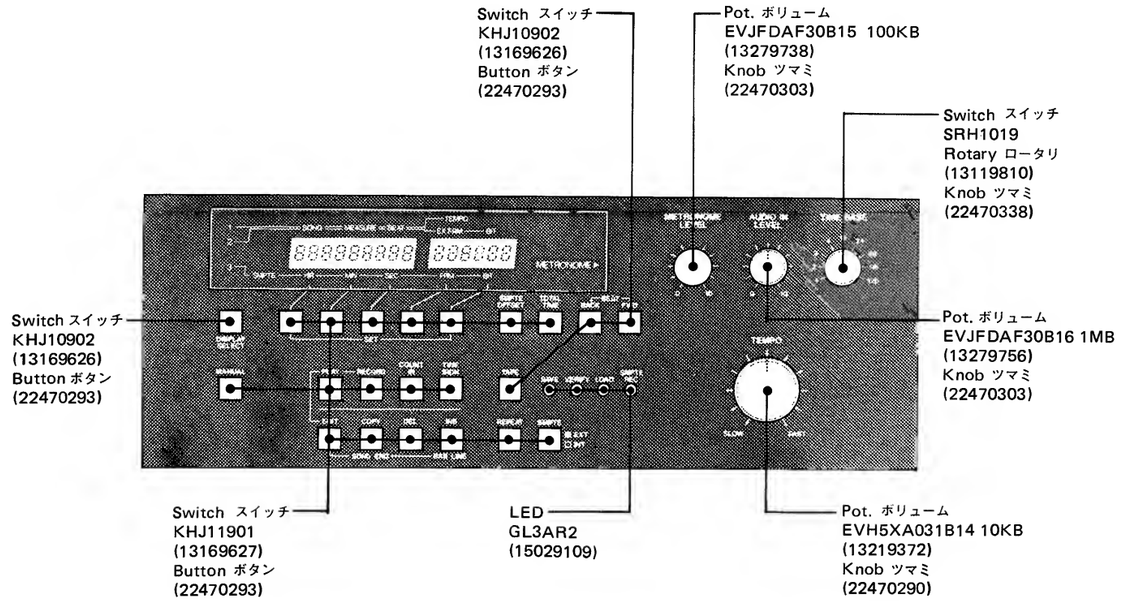
LEVEL	:	1.5Vp-p	
TAPE TRANSFER SPEED	:	NTSC	2400 baud
		PAL/SECAM	2000 baud
FRAME FREQUENCY	:	NTSC	30 FRM/sec
		PAL/SECAM	25 FRM/sec
TIME BASE	:	5Vp-p	
METRONOME	:	1Vp-p max.	

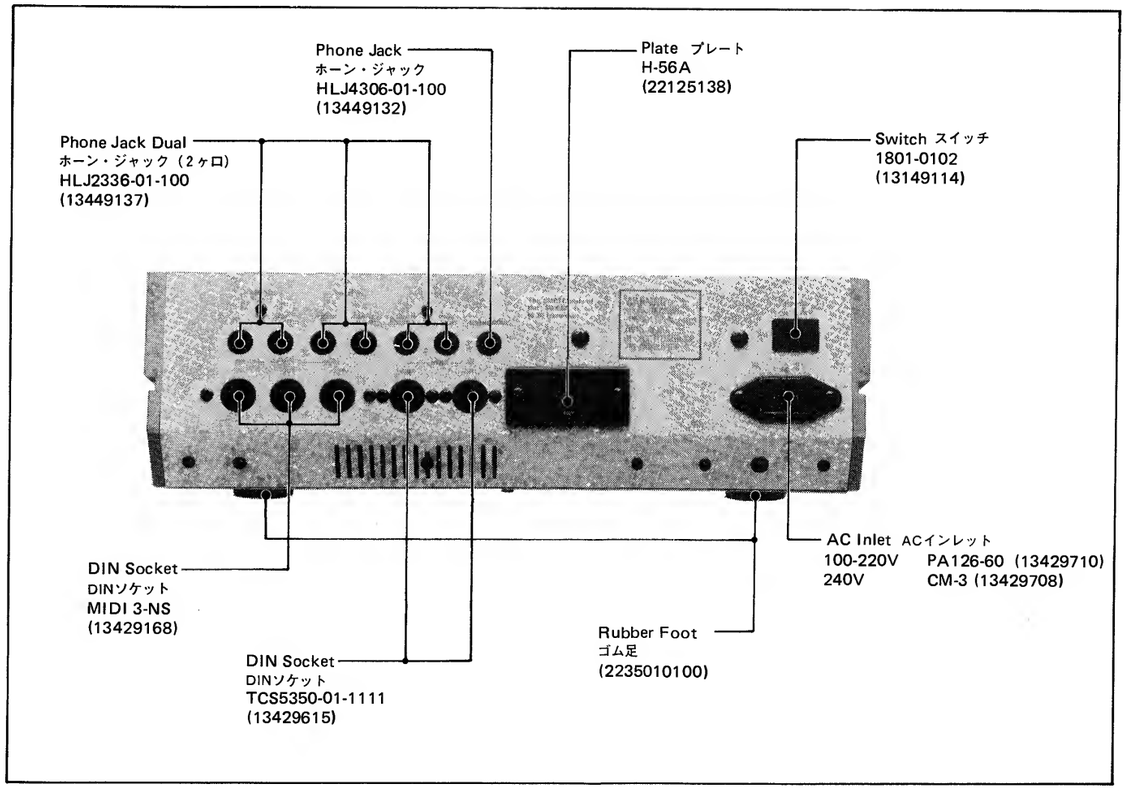
POWER CONSUMPTION : 11W

DIMENSIONS : 325(W) x 303(D) x 107(H) mm/
12-13/16(W) x 11-15/16(D) x 4-3/16(H) in

WEIGHT : 3.5kg / 7 lb 11 oz







PARTS LIST

CASE ケース

2221042403	Panel	パネル
2202025001	Bottom Cover	ボトム・カバー
2112017600	Side Panel Left	側板 左
2112017700	Side Panel Right	側板 右
2235010100	Rubber Foot	ゴム足
2221072500	Display Panel	表示器パネル
2202069000	Polarizer Filter	偏光フィルタ
2202024300	Battery Holder Cover	バッテリ・ホルダ・カバー
2219044200	Holder	ホルダ
12199414	Battery Holder	バッテリ・ホルダ
2219048401	Jack Holder	ジャック・ホルダ
2212513800	H-56A Plate	プレート
15029710	FIP16A5R Fluorescent display	蛍光表示管

KNOB, BUTTON ツマミ, ボタン

2247090700	Button set (includes the following) 0-9,ENTER	ボタン・セット(下記を含む)	
2247034000	Button	ボタン	1
2247034100	Button	ボタン	2
2247034200	Button	ボタン	3
2247034300	Button	ボタン	4
2247034400	Button	ボタン	5
2247034500	Button	ボタン	6
2247034600	Button	ボタン	7
2247034700	Button	ボタン	8
2247034800	Button	ボタン	9
2247034900	Button	ボタン	0
2247035100	Button	ボタン	ENTER
2247029300	Button	ボタン	PLAY,MANUAL,etc.
2247035000	Button	ボタン	SUB TAP,STOP/CONT
2247029100	Button	ボタン	START/TAP
2247033900	Knob	ツマミ	TAP RESPONSE
2247029000	Knob	ツマミ	TEMPO
2247030300	Knob	ツマミ	METRONOME,AUDIO IN
2247033800	Knob	ツマミ	TIME BASE

SWITCH スイッチ

13119810	SRM1019	TIME BASE
13159105	SSP042	PAL-NTSC(SW102)
13159337	SSB023	TAP RESPONSE
13169503	ESE3711	VOLTAGE SELECT
13129341	KFL11904	START
13129340	KFL10903	SUB TAP,STOP,TEN KEY
13169627	KHJ11901	MANUAL,PLAY,etc.
13169626	KHJ10902	FORWARD,BACK,etc.
13149114	1801-0102	POWER

JACK, SOCKET ジャック, ソケット

13449137	HLJ2336-01-100	(dual)(2ヶ口)	jack φ6.5
13449132	HLJ4306-01-100		jack φ6.5
13429618	MIDI3-NS		MIDI socket
13429615	TCS5350-01-1111		DIN socket

PCB 基板完成品

7934406019	Main Board メイン基板	(pcb 2291095603 4/4)
	Replacement PCB includes the PCBs below.	
	補修用完成基板としては、下記3種類の基板を含みます。	
7934411002	Slide Switch Board スライド・スイッチ基板	(pcb 2291095603 1/4)
.....	Regulator Board レギュレータ基板	(pcb 2291095603 2/4)
7934408004	DIN Jack Board DINジャック基板	(pcb 2291095603 3/4)
.....	TB Out Board TBアウト基板	(pcb 2292011000)
	Piggybacked on Main Board prior to SN460300	
	SN460300未満のメイン基板に付属しています。	
7934407006	Switch Board スイッチ基板	(pcb 2291095501 2/2)
	Replacement PCB includes the Phone Jack Board.	
	補修用完成基板としては、ホーン・ジャック基板を含みます。	
7934409004	Phone Jack Board ホーン・ジャック基板	(pcb 2291095501 1/2)

POTENTIOMETER ボリューム

13279738	EVJFDAF30B15	100KB
13219372	EVH5XA031B14	10KB
13279756	EVJFDAF30B16	1MB
13299115	H1051A015-22KB	半固定trimmer

Xtal 発振子

12389733	HC18U 6.4MHz
12389734	HC18U 7.68MHz
12389717	12MHz

FUSE, FUSE HOLDER ヒューズ ヒューズ・ホルダ

12559356	SGC 1A	100/117V	ヒューズ fuse
12559509	CEE T315mA	220/240V	ヒューズ fuse
12199519	TF-758		ヒューズ・ホルダ fuse holder
or			
12199552	UF0005-02		ヒューズ・ホルダ fuse holder

IC

15179176	μPD7811G	CPU
15179138	μPD8251AC	USART
15179196	μPD8279 C-5	display controller
15169301	TTL 74LS00	quad 2 input NAND
15169303	TTL 74LS02	quad 2 input NOR
15169304	TTL 74LS04	hex inverters
15169311	TTL 74LS74	dual D-FFs with preset and clear
15169333	TTL 74LS90	decade counter
15169315	TTL 74LS123	dual retriggerable single shot
15169318	TTL 74LS138	3 to 8 demultiplexer
15169358	TTL 74LS373	octal 3-state D-latches
15169337	TTL 74LS390	dual decade counters
15169329	TTL 74LS393	dual 4-bit binary counters
15159116T0	TC4069UBP	hex inverter
15179336	TC5565PL-15	RAM
15179625H0	HN482764 (HITACHI only)	ROM
15189134	NJM 2904D	OP amp
15149110	M54562	TR array
15219109	NE555P	timmer
15229712	PC900	photo coupler
15199106F0	UA7805UC	+5V voltage regulator
15159316	TC4514BP	4-bit latch/4-to-16 line decoder

TRANSISTOR トランジスタ

15129137	2SC2603F
15129114	2SC1815-GR
15119125	2SA1115F
15129608	2SD637-R
15129816	2SD880-Y

DIODE ダイオード

15019126	1S133		
15019582	RD30EB4	ツェナー	zener
15019528	RD6.2EB2	ツェナー	zener
15019236	W02	ブリッジ整流器	rectifier bridge
15019652	RD5.6E	ツェナー	zener
15029180	LD101UR		LED
15029109	GL3AR2		LED

CAPACITOR コンデンサ

13529104	DE7150F472MVA1	4700pF	セラミック ceramic

CONNECTOR w/lead リード付コネクタ

2341047801	6P, ℓ=120mm
2341047000	5P, ℓ=300mm
2341046800	7P, ℓ= 90mm
2341046900	9P, ℓ=170mm
2341043500	3P, ℓ=150mm
2341043700	10P, ℓ=190mm

CONNECTOR WAFER ASSEMBLY ウェハー・アッセンブリ

13439119	3P, 5045-03A
13439121	5P, 5045-05A
13439123	7P, 5045-07A
13439125	9P, 5045-09A
13439126	10P, 5045-10A

AC INLET ACインレット

13429710	PA126-6.0	100/117/220V
13429708	CM3	240V

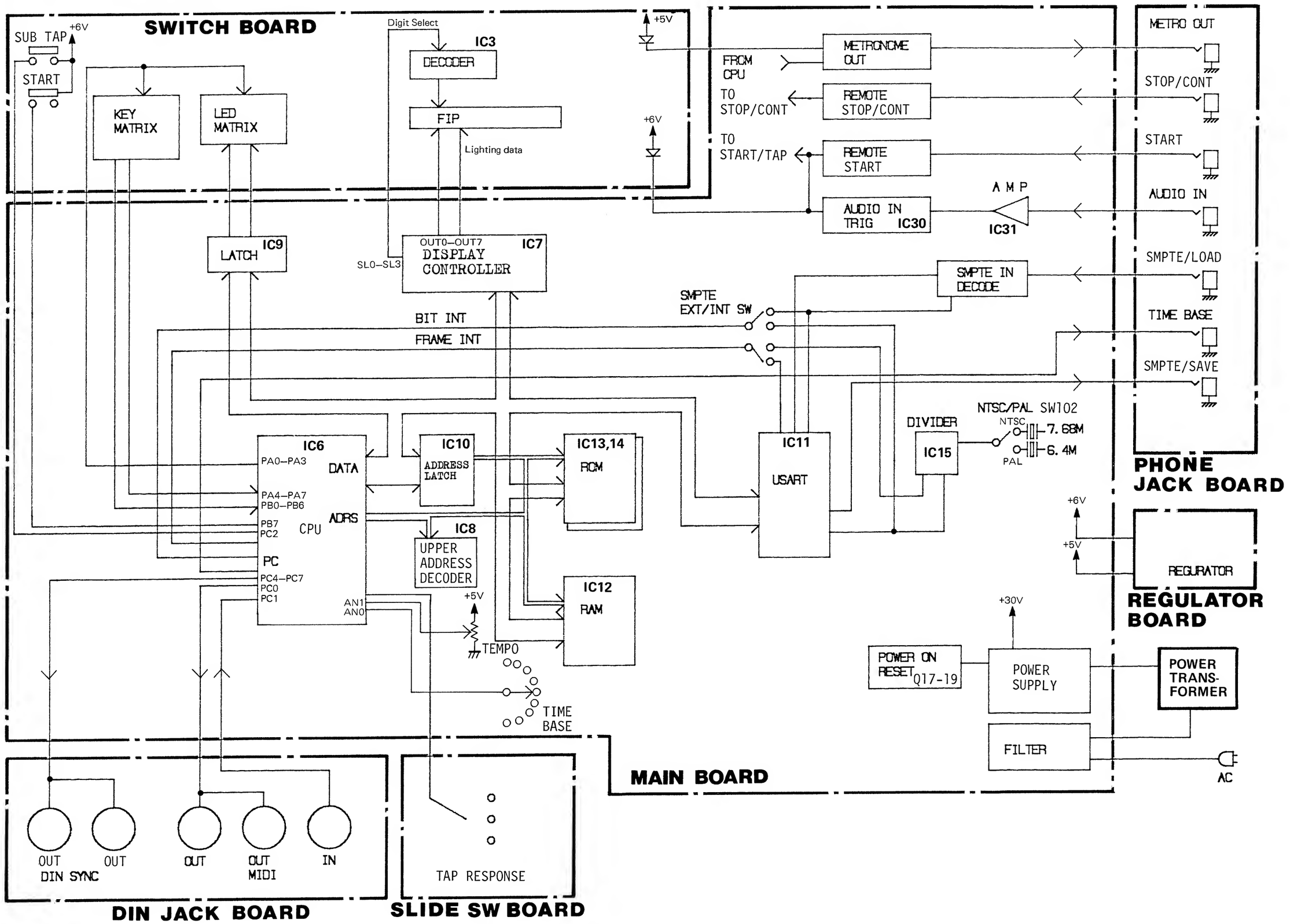
AC CORD SET (DETACHABLE) ACコード・セット(着脱式)

13439811D0	KP210VCTFKS17B	100V
13439812F0	UC-704-J01	117V
13439813F0	EC-201-J06	220V
13439817F0	EC-702-J05	240VE
13439814F0	SC-415-J06	240VA(Australian)

OTHERS その他

12449229	FK0B16MH15	Coil	コイル
12389806	FAF16R02C	Speaker	スピーカ
2246012800		Heat sink	ヒート・シンク
13429527	KEL ICCC03-028-350T	IC Socket 28pin	
13419206	T-250L	Battery Snap	電池スナップ

BLOCK DIAGRAM



CIRCUIT DESCRIPTIONS

The SBX-80 handles MIDI messages (Timing Clock, Start, Continue and Stop), DIN SYNC, TIME BASE and SMPTE as SYNC signals for use to control or to sync with timing-related equipment.

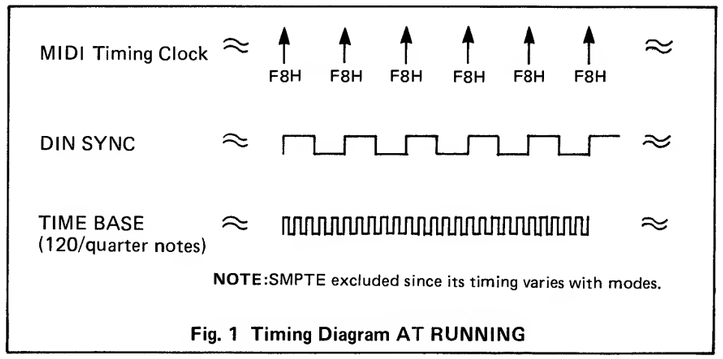


Fig. 1 Timing Diagram AT RUNNING

TIME BASE

The TIME BASE here refers to a clock(s) that represents the duration of a quarter note. When TIME BASE is selected either 1, 2, 3, 4, 12, 24, 48, 96 or 120 from front panel (SW101), the output from voltage divider is connected to AN0 of the CPU IC6 which converts the voltage to digital data through the internal A/D converter and subsequent circuitry then puts out a rectangular wave at PC6.

DIN SYNC

This signal is also called SYNC-24. As the name implies, the number of clocks per quarter note is always 24. The signal is transmitted even in the stop mode.

MIDI SYNC

This is Timing Clock message F8H. The number of F8H which determines the length of a quarter note is 24. Timing Clock is, as is the case of DIN SYNC, sent out from the SBX-80 even in the stop mode.

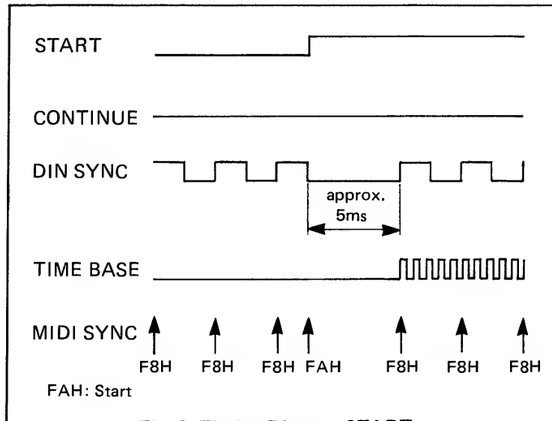


Fig. 2 Timing Diagram START

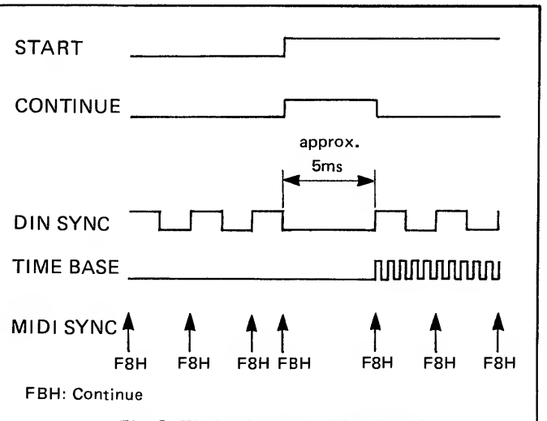


Fig. 3 Timing Diagram CONTINUE

SMPTE TIME CODE

The SBX-80 is capable of using SMPTE as sync signal. The SMPTE TIME CODE consists of 80 bits/television frame -- 2 bytes for each SYNC, SEC, MIN, HOUR and FRM as shown below.

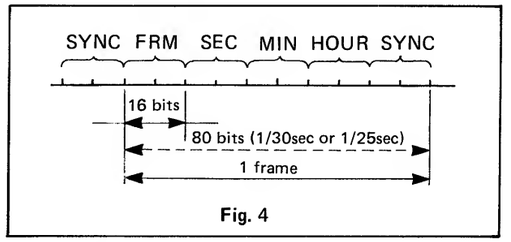
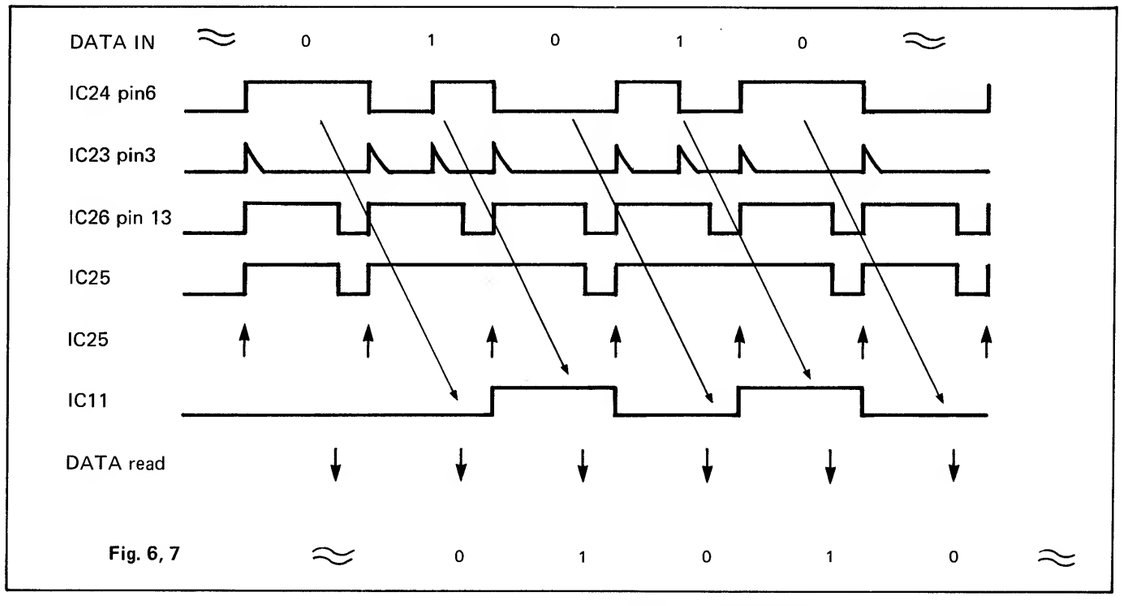


Fig. 4

As the SMPTE code is originally devised for use with television system, its time base varies with television broadcasting system -- that is, a scanning frequency.

Transfer Speed
NTSC: 30 (frame) x 80 (bit) = 2400 baud
PAL/SECAM: 25 (frame) x 80 (bit) = 2000 baud



The time resolution of a sync signal would be 1/30 sec (in NTSC) if SMPTE code is used as it is. In the SBX-80 the bits in the SMPTE code are further utilized to expand the resolution. Each clock corresponding to a SMPTE bit is applied from pin 6 of IC22 to INT1 of the CPU IC6. An event occured on any clock (bit) of the 80 clocks between two adjacent SYNC data is detected when SYNDET from pin 16 of IC11 is fed to PC3 of IC6 as a SMPTE EXT clock.

SMPTE code specifies a time at which a scanning starts to display a particular frame.

Each data of 2 bytes is encoded through Bi-phase modulation method with which bit "1" is indicated by having a level shift called an intermediate transition in the center of the bit period.

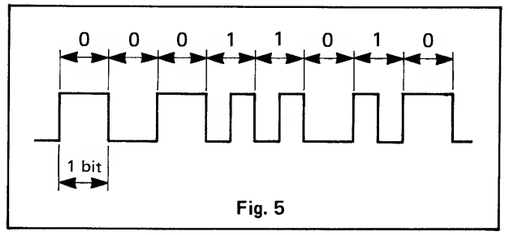


Fig. 5

In the SBX-80 SMPTE code is decoded as shown below.

SWITCH SCANNING

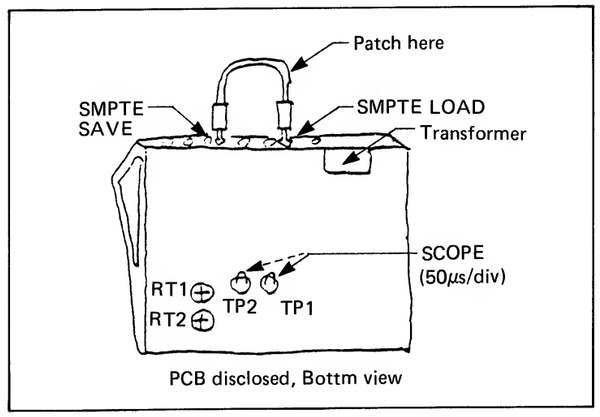
START (TAP) and SUB TAP are read in the CPU IC6 every 2ms while the other switches are 8ms through 4 (PA0–PA3) x 9 (PB0–PB6, PA4–PA5) matrix.

AUDIO IN

An Audio signal (click) at the pin 6 of IC31 is sliced, amplified and applied to IC30 timer. IC30 develops a one-shot pulse of 200ms width regardless of the input pulse duration. If a pulse at pin 1 of IC31 is longer than 200ms, IC30 outputs two consecutive pulses.

ADJUSTMENT

CONNECTION, TEST POINTS, TRIMMERS

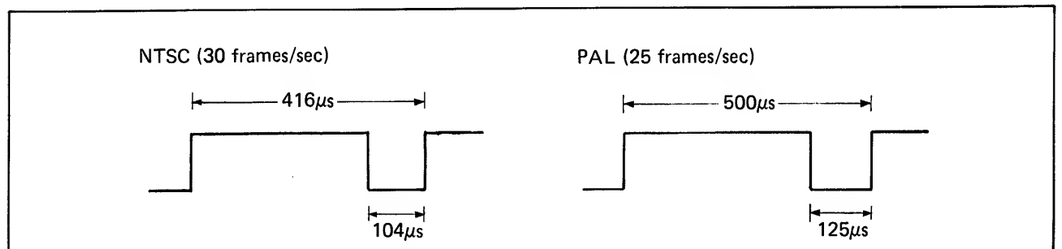


PULSE WIDTH

Connect the scope to TP1.
Adjust RT1 for either 416μs or 500μs according to the version.

パルスワイズ調整

オシロスコープをTP1に接続する。
SW102の設定(NTSCかPAL)に応じてパルスワイズが図の値になる様にRT1を調整する。

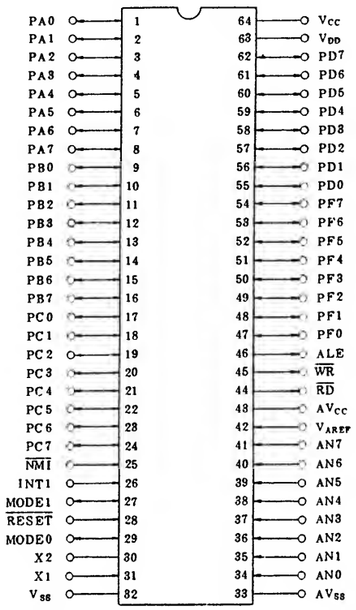


Press TAPE for lighting up SMPTE REC indicator.
Press START.
Connect scope to TP2. The waveforms will slightly jitter; this is normal.
Adjust RT2 for the pulse width as shown above in TP1.

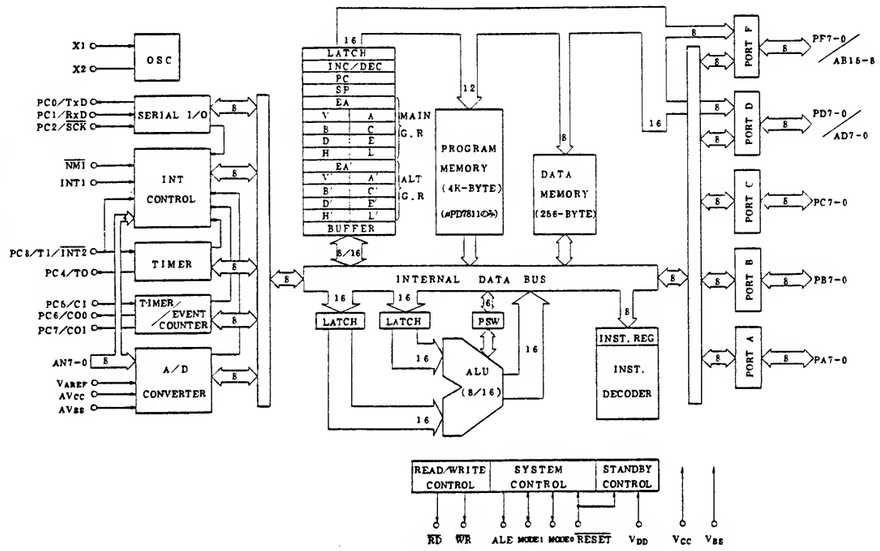
オシロスコープをTP2に接続する。
本機をテープ・モードのSMPTE/RECに設定する。
スタート・ボタンを押す。
パルスワイズがRT1の場合と同じになる様に、RT2を調整する。
(この場合波形にはジッタが生じる)。

μPD7811

Pin Configuration (Top View)

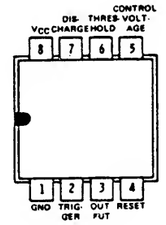


Block Diagram

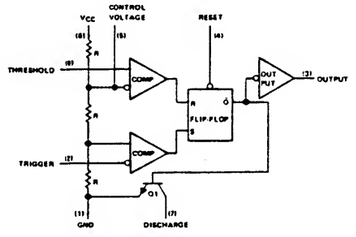


NE555P

Pin Configuration (Top View)

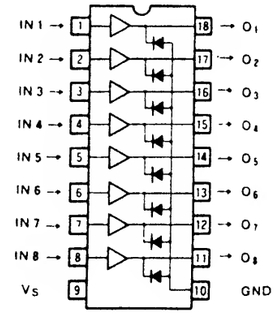


Block Diagram



M54562

Pin Configuration (Top View)



MAIN BOARD
7934406019
(pcb 2291095603)

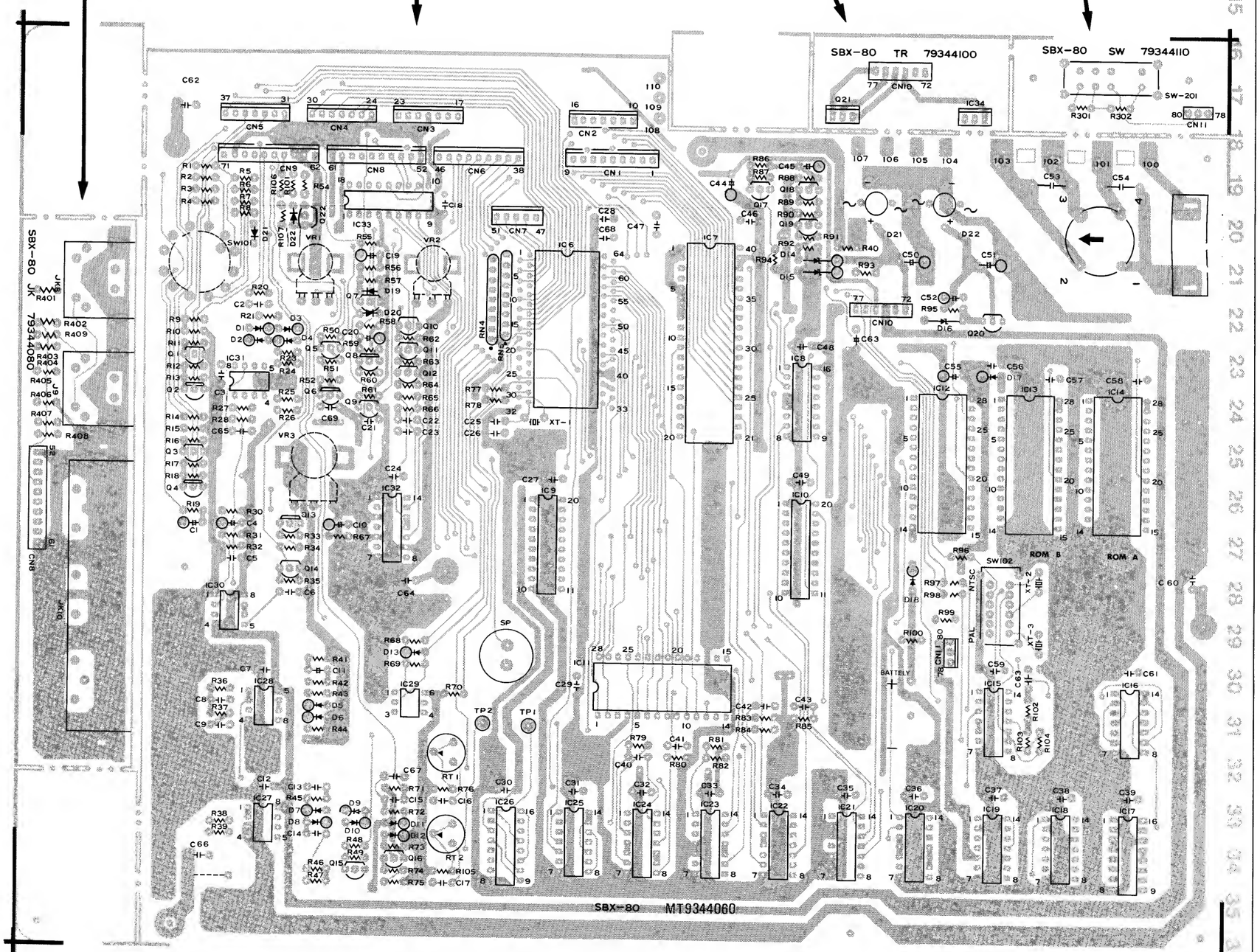
Replacement PCB includes the PCBs shown below.
補修用完成基板としては、下記に示す基板を含みます。

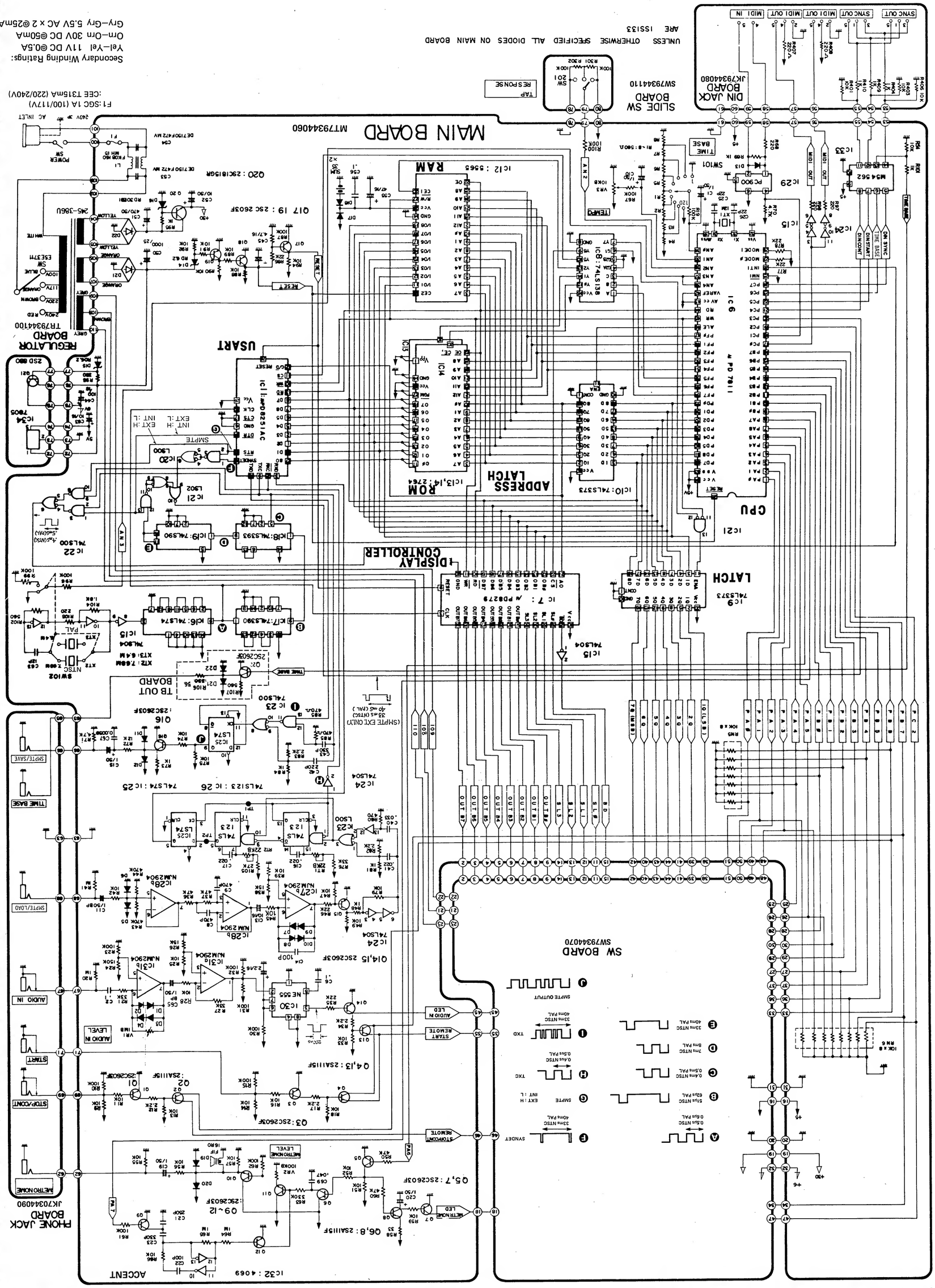
DIN JACK BOARD
7934408004
(pcb 2291095603 3/4)

MAIN BOARD
7934406019
(pcb 2291095603 4/4)

REGULATOR BOARD
(pcb 2291095603 2/4)

SLIDE SWITCH BOARD
7934411002
(pcb 2291095603 1/4)



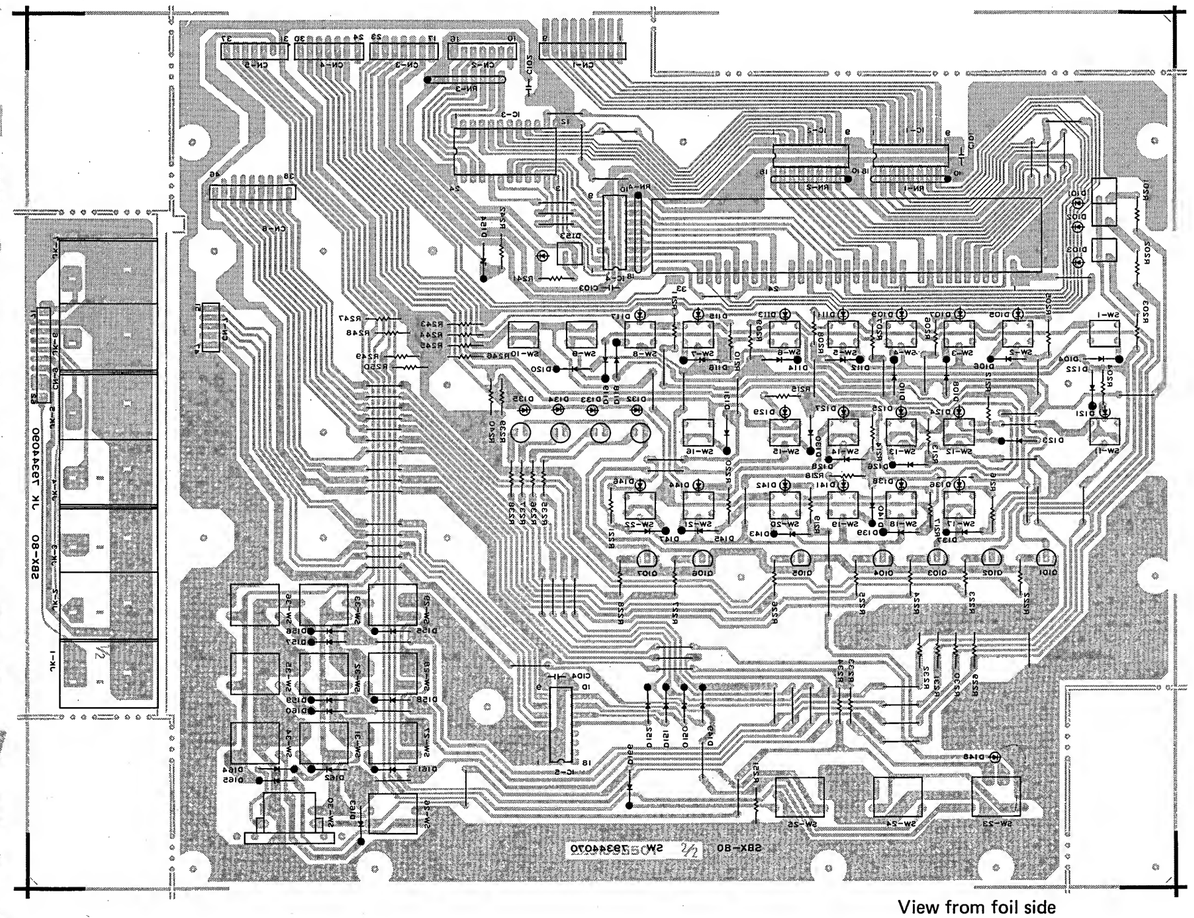

MAIN BOARD
MT7934060
SLIDE SW BOARD
SW7934110
DIN JACK BOARD
JK7934080
UNLESS OTHERWISE SPECIFIED ALL DIODES ON MAIN BOARD ARE 1SS133
Secondary Winding Ratings:
Yel–Yel 11V DC @0.5A
Orn–Orn 30V DC @50mA
Gry–Gry 5.5V AC x 2 @25mA
F1:SGC 1A (100/117V)
:CEE T315mA (220/240V)
REGULATOR BOARD
TR7934100
USART
RAM
ROM
ADDRESS LATCH
CPU
LATCH
DISPLAY CONTROLLER
TB OUT BOARD
SW BOARD
SW7934070
PHONE JACK BOARD
JK7034090
ACCENT

SWITCH BOARD
7934407006
(pcb 2291095501)

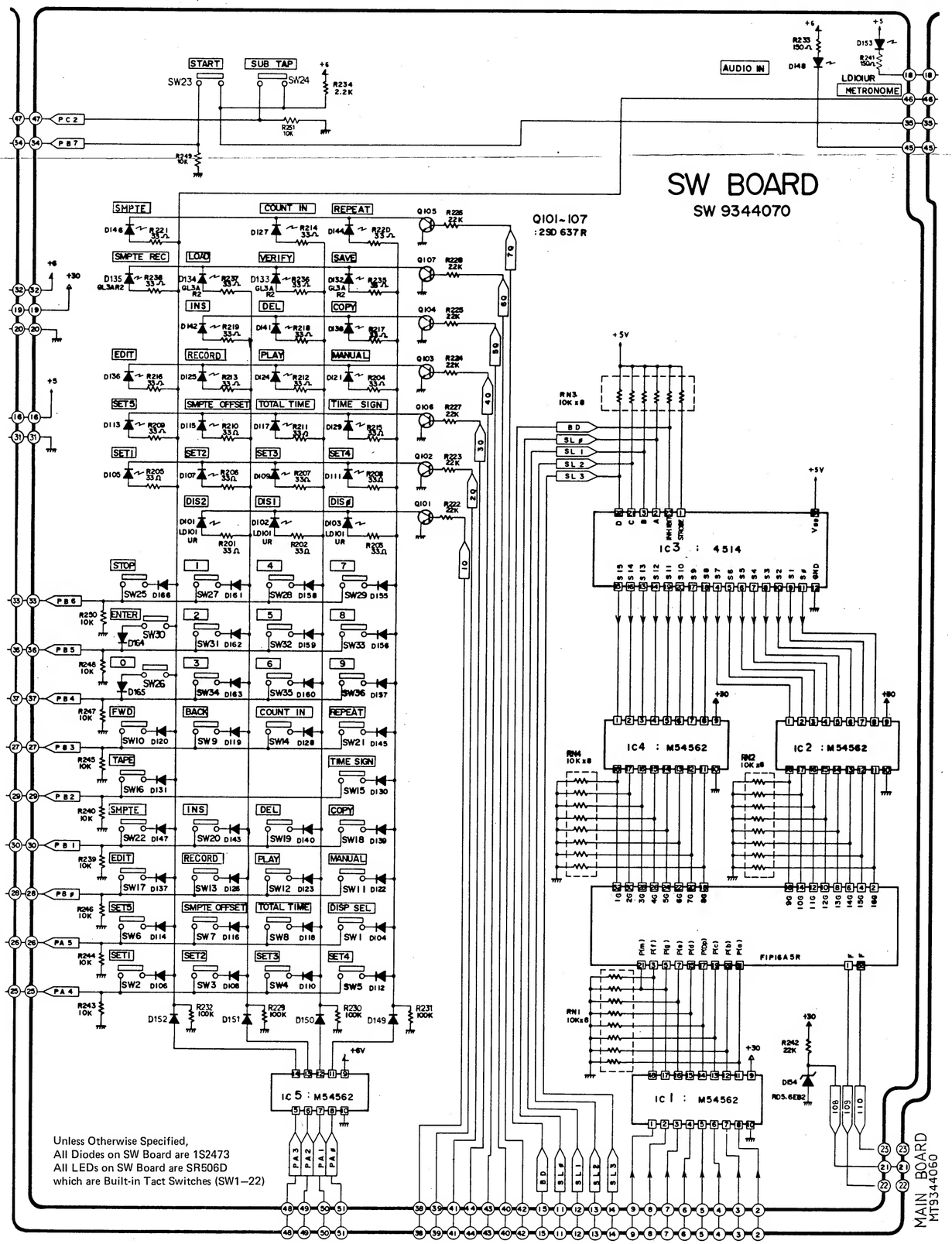
Replacement PCB consiste of two PCBs as shown below.
補修用完成基板としては、下記２種類の基板を含みます。

PHONE JACK BOARD
7934409004
(pcb 2291095501 1/2)

SWITCH BOARD
7934407006
(pcb 2291095501 2/2)



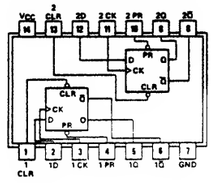
View from foil side



IC DATA

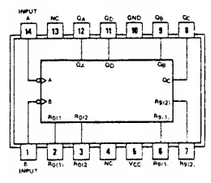
74LS74

Pin Configuration
(Top View)



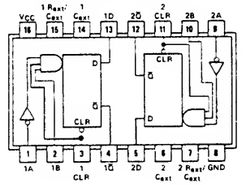
74LS90

Pin Configuration
(Top View)



74LS123

Pin Configuration
(Top View)

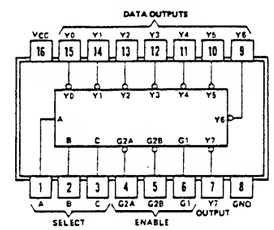


Truth Table

INPUTS			OUTPUTS	
CLEAR	A	B	Q	$\bar{Q}$
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⎍	⎎
H	↓	H	⎍	⎎
↑	L	H	⎍	⎎

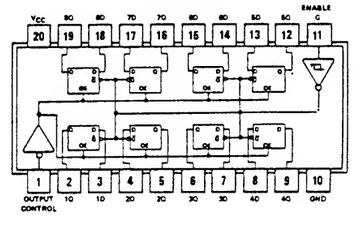
74LS138

Pin Configuration
(Top View)



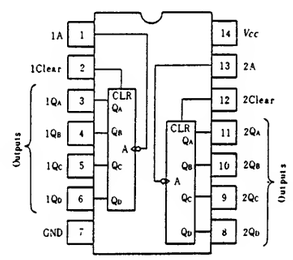
74LS373

Pin Configuration
(Top View)



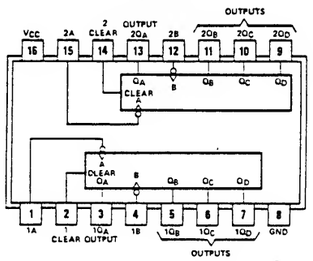
74LS393

Pin Configuration (Top View)



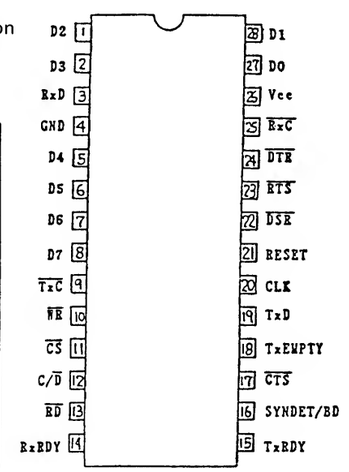
74LS390

Pin Configuration
(Top View)

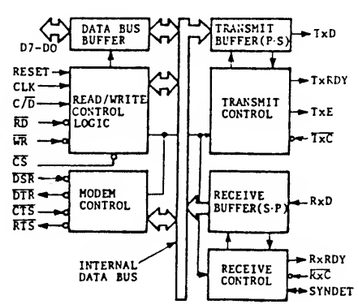


μPD8251AC

Pin Configuration
(Top View)



Block Diagram



D7-D0	Data Bus (8 bits)
C/$\bar{D}$	Control or Data is to be Written or Read
$\overline{RD}$	Read Data Command
$\overline{WR}$	Write Data or Control Command
$\overline{CS}$	Chip Enable
CLK	Clock Pulse (TTL)
RESET	Reset
$\overline{TxC}$	Transmitter Clock
TxD	Transmitter Data
$\overline{RxC}$	Recover Clock
RxD	Receiver Data
RxRDY	Receiver Ready (has character for 8080)
TxRDY	Transmitter Ready (ready for char. from 8080)
$\overline{DSR}$	Data Set Ready
DTR	Data Terminal Ready
SYNDET/BD	Sync Detect/Break Detect
$\overline{RTS}$	Request to Send Data
$\overline{CTS}$	Clear to Send Data
TxE	Transmitter Empty
V_{cc}	+5 Volt Supply
GND	Ground

MIDI IMPLEMENTATION

1. TRANSMITTED DATA

1.1 While in MANUAL, PLAY, RECORD or EDIT mode

Status	Second	Third	Description	
1111 0010	0ppp pppp	0ppp pppp	Song Position Pointer	*1
1111 0011	0sss ssss		Song Select	*2
1111 1000			Timing Clock	*3
1111 1010			Start	
1111 1011			Continue	
1111 1100			Stop	

Notes:

*1 While in PLAY mode, and when the SMPTE switch is set at EXT, this unit will work in the AUTO-SYNC mode, then when the recorded SMPTE code signal is received from the TAPE SYNC IN, a proper Song Position Pointer first, then a Continue are transmitted.
While in PLAY mode, when the measure of the song is set by the numeric keyboard, the Song Position Pointer is sent.

*2 When a song number is chosen by the numeric keyboard on the front panel.

*3 The Timing Clock is always transmitted even when receiving or transmitting the System Exclusive message.

1.2 While in TAPE mode

Only the System Exclusive Messages are transmitted for data communication as described in section 4.

2. RECOGNIZED RECEIVE DATA

2.1 While in MANUAL, PLAY, RECORD or EDIT mode

No messages are recognized for its internal function.

2.2 While in TAPE mode

No messages, except the System Exclusive, are recognized for its internal function.

3. TRANSFERRED RECEIVE DATA

3.1 While in MANUAL, PLAY, RECORD or EDIT mode

The following messages received from MIDI IN are directly transmitted to MIDI OUT.

Status	Second	Third	Description
100x nnnn	0kkk kkkk	0vvv vvvv	Note ON/OFF
1010 nnnn	0kkk kkkk	0vvv vvvv	Key after touch
1011 nnnn	0ccc cccc	0vvv vvvv	Control change, Mode message
110x nnnn	0vvv vvvv		Program change, Channel after touch
1110 nnnn	0vvv vvvv	0vvv vvvv	Pitch bender
1111 0000	0iii iiii	0ddd dddd	..... 1111 0111 System Exclusive message
1111 0110			Tune request
1111 0111			EOX
1111 1110			Active sensing
1111 1111			System reset

3.2 While in TAPE mode

Messages described in 3.1, except the System Exclusive messages, are transferred. However, while communicating with the other unit by using the SBX-80's System Exclusive messages, which is described in section 4, no other messages are passed from MIDI IN to MIDI OUT.

4. SBX-80 EXCLUSIVE MESSAGES

While in MANUAL, PLAY, RECORD or EDIT mode, All System Exclusive messages received from MIDI IN are directly transmitted to MIDI OUT.

While in TAPE mode, only the following messages are transmitted or recognized. All of other System Exclusive messages are ignored.

4.1 Message type

4.1.1 Want to send a file -- WSF recognized only

Byte		Description
1111 0000	F0H	Exclusive status
0100 0001	41H	Roland ID #
0101 0000	40H	Operation code = WSF
0111 1111	7FH	Unit number = no channel device
0110 0000	60H	Format type = SBX data
1111 0111	F7H	End of Exclusive

4.1.2 Request a file -- RQF recognized only

Byte		Description
1111 0000	F0H	Exclusive status
0100 0001	41H	Roland ID #
0101 0000	41H	Operation code = RQF
0111 1111	7FH	Unit # = no channel device
0110 0000	60H	Format type = SBX data
1111 0111	F7H	End of Exclusive

4.1.3 Data -- DAT

Byte		Description
1111 0000	F0H	Exclusive status
0100 0001	41H	Roland ID #
0101 0000	42H	Operation code = DAT
0111 1111	7FH	Unit # = no channel device
0110 0000	60H	Format type = SBX data
(00hh 0000)		(header 10H or 20H)
0000 dddd		
:		Data (max 256 bytes)
0000 dddd		
0sss ssss		Check sum
1111 0111	F7H	End of Exclusive

4.1.4 Acknowledge -- ACK

Byte		Description
1111 0000	F0H	Exclusive status
0100 0001	41H	Roland ID #
0101 0000	43H	Operation code = ACK
0111 1111	7FH	Unit # = no channel device
0110 0000	60H	Format type = SBX data
1111 0111	F7H	End of Exclusive

4.1.5 End of file -- EOF

Byte		Description
1111 0000	F0H	Exclusive status
0100 0001	41H	Roland ID #
0101 0000	45H	Operation code = EOF
0111 1111	7FH	Unit # = no channel device
0110 0000	60H	Format type = SBX data
1111 0111	F7H	End of Exclusive

4.1.6 Communication error -- ERR recognized only

Byte		Description
1111 0000	F0H	Exclusive status
0100 0001	41H	Roland ID #
0101 0000	4EH	Operation code = ERR
0111 1111	7FH	Unit # = no channel device
0110 0000	60H	Format type = SBX data
1111 0111	F7H	End of Exclusive

4.1.7 Rejection -- RJC

Byte		Description
1111 0000	F0H	Exclusive status
0100 0001	41H	Roland ID #
0101 0000	4FH	Operation code = RJC
0111 1111	7FH	Unit # = no channel device
0110 0000	60H	Format type = SBX data
1111 0111	F7H	End of Exclusive

4.2 Sequence of communication

While in one of TAPE modes (SAVE, VERIFY, LOAD or SMPTE REC) and when these functions are not operating, only the WSF and RQF are recognized, then when the WSF or RQF message is received, the communication sequence will start.

This unit does not have functions to begin the communication by itself.

4.2.1 When the WSF is received.

WSF	received
ACK	transmitted
DAT	received
ACK	transmitted
:	
:	
EOF	received
ACK	transmitted

4.2.2 When the RQF is received.

RQF	received
DAT	transmitted
ACK	received
:	
:	
EOF	transmitted
ACK	received

4.2.3 When the ERR is received while communicating.

DAT	transmitted
ACK	received
RJC	transmitted

4.2.4 When the RJC is received while communicating.

RJC	received

The communicating function will stop.

4.3 Data format in the DAT messages

Each byte of the data divided 2 nibbles, right justified, LS nibble (lower nibble) is sent first.

a. File header block (in the first DAT message)

Byte in DAT		Description
0001 0000	10H	Header
		SMPTE OFFSET
0000 hhhh		Lower nibble of Hour
0000 hhhh		Upper nibble of Hour
0000 mmmm		Lower nibble of Minute
0000 0mmm		Upper nibble of Minute
0000 ssss		Lower nibble of Second
0000 0sss		Upper nibble of Second
0000 ffff		Lower nibble of Frame
0000 00ff		Upper nibble of Frame
0000 bbbb		Lower nibble of Bit
0000 0bbb		Upper nibble of Bit
0000 000d		Beat division 0: 1/4, 1: 1/8
0000 000m		Metronome 0: no count 1: count

b. Measure control block (in the second DAT message)

Byte in DAT	Description
	Beat per measure (1 - 15)
0000 bbbb	Lower nibble
0000 0000	Upper nibble
	Number of measures - 1
	(0 - 997)
0000 mmmm	Lower nibble of lower byte
0000 mmmm	Upper nibble of lower byte
0000 00mm	Lower nibble of upper byte
0000 0000	Upper nibble of upper byte
...	
...	Sets of 6 bytes
0000 0000	Data end mark (6 bytes)
0000 0000	
0000 0000	
0000 0000	
0000 0000	
0000 0000	

Notes:

If the 2 measure count-in exists, the lower nibble of the first 'beat per measure' is the number of the beat, then the upper nibble of the first 'beat per measure' is 0000 1000, and the next 4 bytes are 0000 0001, 0000 0000, 0000 0000, 0000 0000 respectively, which indicate number of the count-in measures being 2.

If the number of bytes exceeds 256, the third message will follow from the next nibble.

Total of the measures will not exceed over 998.

c. Data length block (in the third or fourth DAT message)

Byte in DAT		Description
0010 0000	20H	Header
		Length of data bytes (0 - 7934) *
0000 xxxx		Lower nibble of lower byte
0000 xxxx		Upper nibble of lower byte
0000 xxxx		Lower nibble of upper byte
0000 000x		Upper nibble of upper byte

Note :

* The length value equals doubled number of beats the song data consists of.

d. Tempo data block

Byte in DAT	Description
	Tempo values in SMPTE format for the first beat
0000 bbbb	Lower nibble of Bit value
0000 0bbb	Upper nibble of Bit value
0000 ffff	Lower nibble of Frame value
0000 0fff	Upper nibble of Frame value
...	
...	Sets of 4 bytes for each beat
...	
	Additional 4 byte data (same values of the end beat data)
0000 eeee	Lower nibble of Bit value
0000 0eee	Upper nibble of Bit value
0000 eeee	Lower nibble of Frame value
0000 0eee	Upper nibble of Frame value